Claims 1-16 are rejected under 35 U.S.C. § 102 as being unpatentable over Sutter or White et al separately. Amendments requested to drawing figures and specification are made herein and hereunder through the attachments. Substitute drawing figures 2-4, 26 and 29 are enclosed with this response. Claims 1 and 10 are amended in response to rejections under 35 U.S.C. §§ 102 and 112.

The independent claims have been amended as method claims. It was noted in the last office action that a pencil's prior use as a fingernail cleaner made it available to make another device obvious. The claims are now entirely for the use of a thermokinetic device to melt plastics with flat teeth faces that drive the particles to one side or another or that have replaceable shaft extensions. The art of thermokinetic mixing to melt plastics is not one that allows the changing of shaft extensions like someone can clean fingernails with a pencil or some other pointed object.

Thermokinetic mixing at high speed in the prior art uses impingement of plastics on metal surfaces with a very specific set of substantially oval cross-section and highly curved shaft extensions that are welded onto a shaft. No reference and no prior art device gives any suggestion that any other configuration would work. The device shown in the Bowen patent is a slow moving masticator. At most, it can accomplish only the feed screw function of the invention.

The present inventors have found that a claimed major face on a shaft extension causes most of the feed particles that strike it to be driven funnel-like to one side of that rotating shaft extension. This sets up an impingement with a next shaft extension so that the meltable plastics ricochet heavily among the shaft extensions for thermokinetic melting instead of at the inside surface of the mixing chamber. The prior art describes that the purpose of the shaft extensions is to generate thermokinetic impingement on the inside surface of the mixing chamber, i.e., resulting in the substantially amorphous curved shaft extensions of the prior art devices. Those amorphous curved shaft extensions are the result of many years of research by the two companies that produce such machines. No

machine or publication to date, except for the invention device, has hinted that any other shaft extension could achieve thermokinetic effects on plastics. Sutter and White are entirely unrelated at to processes and effects on their feed materials as compared with a thermokinetic mixer.

The shaft extensions of Sutter must operate at slow speed to knead dough and is not intended to generate plastic melting heat by its mixing process. The bolted shaft extension of Sutter would never survive the high speeds at the high horsepower needed for thermokinetic devices. The shaft extensions of White would be tinsel under those conditions.

The severe operating conditions of thermokinetic mixing have made it previously unthinkable to make replaceable shaft extensions. Users of prior art devices must replace an entire shaft if the shaft extensions are worn, a practice that has existed for at least 15 years. The shaft and extensions of the prior art devices are made of extremely tough and expensive alloy materials. The present invention providing replaceable extensions makes it possible to replace in most circumstances only a tooth face portion while retaining all the rest of the shaft and base portion.

The design of prior art thermokinetic mixers never anticipated their use for melting of plastics. Prior art thermokinetic mixers are used almost entirely for compounding, not melting, polymers with things like pigments. The invention device is the first designed for the more rigorous and severe process of melting plastics to produce a molten material with substantially homogenous properties without striations or fracture lines.

High rotational speed and high horsepower must be delivered to the shaft. Below a definite rotational speed, polymers do not impinge the inside surface or the extensions with enough shear force to be pulled like taffy and generate heat thereby. The present invention as described in the specification and drawing figures show that each shaft extension is "adapted to encounter the particles and drive them at least in part to the inside surface

such that substantial energy is imparted to them". The shaft extensions adapted according to the invention must extend to very close to the inside surface of the chamber. The limitations of Claims 5 and 14 are appropriate as the specification describes appropriate starting ranges for determination of what "near" should be as to the top of the shaft extensions and the inside surface of the mixing chamber to accomplish the object of the invention.

The present inventors have discovered a method of operating a thermokinetic melt blending device with a new set of shaft extensions. One skilled in the art would not have known how or been taught to experiment to change the prior art shaft extensions to obtain a funneling effect by forming major tooth faces causing all particles striking the face to be channeled not primarily to the inside surface of the mixing chamber but to yet another shaft extension for thermokinetic impingement. The claimed invention is not anticipated or made obvious by the references.

Consideration of the above amendments and remarks is requested and it is submitted that such amendments and remarks place the application in a condition for allowance for claims 1-16. Applicant requests entry of amendments and allowance of such claims.

Respectfully submitted, Dated: Dec. 20, 2002

David T. Bracken

David T. Bracken
Registration No. 37,522
Phone: (714) 744-4798

APPENDIX 1

This Appendix 1 is incorporated in the above amendment made in this application and contains the amended paragraphs of the specification and claims in the form showing stricken material in brackets and new material as underlined.

Specification Amendments

Page 3, lines 29-31; Pages 4 and 5, all lines; Page 6, lines 1-16 :

Figures 1 and 2 show respectively assembled and exploded perspective views of the invention mixer assembly. The reference numbers of Figures 1 and 2 are used only for those figures, although the referenced component names refer to substantially identical components among all the figures. For Figures 1 and 2, a frame 1 supports associated components such that a shaft assembly 2 is inserted in an axis of a shaft hole through end plate 3 and a feed screw hole through end plate 4, the two end plates defining enclosing ends of a mixing chamber cylinder, the bottom portion of the cylinder defined by the inside surface of the lower housing 5. Lower housing 5 comprises a dropout opening closed off during operation with discharge door 6. The upper housing 7 comprises an upper part of the cylinder of the inside surface of the mixing chamber of the invention. The feed housing 8 is adapted to permit feeding of material to the feed screw of the shaft assembly so that such material is, in combination with the feed screw rotation, compressingly forced into mixing chamber from an external feed. Door 6 rotatably closes about discharge door pivot pin 9. End plate 3 has attached to it a rack & pinion cylinder 18 with spacer 10 interposed. At the top of housing 7 is mounted a bracket 11 with which to support an IR temperature sensor 20 for the mixing chamber. Door guard 12 protects the sometimes high temperature door [5] <u>6</u> from accidental human contact with dropout material. Rotary guard 13 and drive coupling guard 14 guard human operators from contact with rotating components during operation. Drive motor 15 is preferably an electric motor with sufficient power to accomplish the invention operation, but in a specific example below is about 150 HP. The pillow blocks 16 and 17 support the shaft assembly 2.

Figure 3 shows an exploded view of the shaft assembly 2 of Figure 2. The reference numbers of Figure 3 are used only for that figure and in Figure 4, although the referenced component names refer to substantially identical components among all the figures. A series of connected shafts comprise shaft components [1] <u>1'</u> supported at one end on the bearing 6. The feed screw 2 engages at the visible end of its hollow shaft the noticeable spline of the shaft components 1' such that appropriate rotation of the shaft causes the feed screw also to rotate. One preferred form of the invention comprises the tooth bases 3 being connected to either of a left edge tooth 4 or a right edge tooth 5 by slots and keys and tooth base screws 8 to teeth 4 or 5, whereafter the bases 3 are connected by slots and keys and tooth base to shaft screws 7 to the shaft, thereby forming removable base 3 and teeth 4 or 5 assemblies. This removable assembly concept for thermokinetic mixers is unknown in the prior art. The breadth of the concept of this aspect of the invention includes providing equivalent removable shaft extensions for all thermokinetic mixers. The disclosure herein enables the skilled person to adapt the removable extension concept to such prior art devices as disclosed above. The concept of the abutting slot and key attachments with securing screws has heretofore been unknown. More specifically, the base 3 may be attached by welding wherein only a portion of the shaft extension is removably attached as described herein. Or in the alternate, the teeth 4 or 5 or equivalent end portion of a shaft extension are a single piece with a base 3 or its equivalent in the prior art, the entire shaft extension thereafter being removable as disclosed herein for base 3 from the shaft comprising slots therefore. First row slots teeth sets 101', second row slots teeth sets 102', third row slots teeth sets 103', and fourth row slots teeth sets 104' correspond respectively with the first row slots 101, second row slots 102, third row slots 103, and fourth row slots 104 as shown and described in and for Figure 4. The pattern of teeth 4 and 5 in Figure 3 are a preferred embodiment of the invention. In one embodiment, a row slots teeth set comprises all teeth 4 or 5. In another embodiment, all row slots teeth sets comprise all teeth 4 or 5 or each rotationally successive row slots teeth set comprises all teeth 4 followed by one of all teeth 5. In the embodiment of Figure 3, each row slots teeth set comprises two teeth 4 or 5 whereby the rotationally adjacent row slots teeth sets to each such set comprises two teeth 5 or 4 respectively. A most specific embodiment of Figure 3 shows first row slots

teeth sets 101' with left to right teeth 5 / 4 / 4, second row slots teeth sets 102' with left to right teeth 5 / 4 / 5, third row slots teeth sets 103' with left to right teeth 4 / 5 / 4, and fourth row slots teeth sets 104' with left to right teeth 5 / 4 / 4. As shown in Figure 4, this pattern produces a set to set staggering of the teeth faces as they rotate into a plane passing through the shaft 100 axis. This sets pattern of teeth faces

With reference to rest of the Figures 4-17, shaft components [1] 1' are further shown to comprise an attachment shaft section 100 whereupon are located some of the attachment means for attaching bases 3 to the shaft components 1. In this side view, first row slots 101, second row slots 102 and third row slots 103 are visible, a fourth row slots 104 existing on the opposite side of the section 100 and further disclosed in Figure 6.

Claim Amendments

1. (Twice amended) A method for using a thermokinetic mixer comprising:

(f) a substantially cylindrical mixing chamber with an inside surface enclosing a shaft [rotatable] rotating at relatively high speed substantially about the axis of the cylindrical mixing chamber, the mixing chamber [adapted to receive] being fed a particulate feed material comprising an effective amount of particles of polymers meltable at operating conditions [and other material therein] , the feed material being fed to an inlet port at an end of the mixing chamber from a screw feeder; [and]

(g) shaft extensions [removable from the shaft, the shaft extensions adapted to encounter the particles and drive them at least in part to the inside surface such that substantial energy is imparted to them] secured to the shaft by slot means for removing the shaft extensions when the mixing chamber is emptied and the shaft is stopped;

(h) rotating the shaft at relatively high speed until substantially all the polymer particles melt by heat generated by impingement of polymer particles on the shaft extensions and the inside surface of the mixing chamber so that a blend is formed with other portions of the feed material to form a molten mass of substantially uniform consistency and capable of being compression molded;

(i) opening a door at a bottom part of the mixing chamber and releasing the molten mass from the mixing chamber; and

(j) stopping the shaft from rotating and removing from the shaft one or more of the shaft extensions.

5. The mixer of claim 3 wherein the shaft extensions [rises] rise from the shaft to very close to the inside surface.

10. (Twice amended) A method for using a thermokinetic mixer comprising:

(e) a substantially cylindrical mixing chamber with an inside surface enclosing a shaft [rotatable] rotating at relatively high speed substantially about the axis of the cylindrical mixing chamber, the mixing chamber [adapted to receive] being fed a particulate feed material comprising an effective amount of particles of

polymers meltable at operating conditions [and other material therein] , the feed material being fed to an inlet port at an end of the mixing chamber from a screw feeder;

(f) three or more shaft extensions arranged in a row lengthwise on and radially from the shaft, each shaft extension comprising a major tooth face [, each shaft extension adapted to encounter the particles and drive them at least in part to the inside surface such that substantial energy is imparted to them] oriented such that during rotation of the shaft the major tooth face passes through a plane including the shaft axis first at a leading edge and thereafter only along a substantially flat or slightly curved surface extending from the leading edge rearward from the leading edge and at an acute angle rearward from the plane, whereby feed material particles strike the shaft extension and more than a majority of those particles strike the major tooth face causing them to be substantially all driven to a side of the shaft extension opposite the leading edge; [and]

(g) [the tooth face comprising a major face, the major face being substantially flat and oriented such that when passing through a plane including the shaft axis the major face first encounters the plane with a leading edge of the major face and the major face extends along an acute angle therefrom away from the plane] rotating the shaft at relatively high speed until substantially all the polymer particles melt by heat generated by impingement of polymer particles on the shaft extensions and the inside surface of the mixing chamber so that a blend is formed with other portions of the feed material to form a molten mass of substantially uniform consistency and capable of being compression molded; and

(h) opening a door at a bottom part of the mixing chamber and releasing the molten mass from the mixing chamber.

14. The mixer of claim 13 wherein the shaft extensions [rises] rise from the shaft to very close to the inside surface.